NS 1.22/10:995/1

National Science Foundation

Engineering News

Spring 1995

ENG Plays Key Role In Areas of National Interest

The Directorate for Engineering (ENG), with its research and education programs in manufacturing and in civil infrastructure systems, is playing a key role in NSF's collaboration with other federal agencies in areas of national interest.

Identified as being of particular importance to the nation and chosen after consultation with other government agencies, industry, and academe, the areas are:

- Advanced materials and processing
- Biotechnology
- Civil infrastructure systems
- Environment and global change;
- High performance computing and communications
- Manufacturing
- Science, math, engineering and technology education

In many cases, the NSF investment is formally part of larger interagency efforts that are coordinated by the National Science and Technology Council (NSTC), established by an executive order from President Clinton. The NSTC consists of cabinet officers and agency heads with the President and Vice President as its chair and vice chair, respectively.

Although these areas are not new program initiatives, they do tie a set of ongoing NSF-funded programs together in a way that emphasizes their synergy. An important goal of establishing these groupings is to enable researchers with different disciplinary specialties to interact easily on issues of mutual concern. Within NSF, program officers representing different science and engineering specialities work together to review proposals, plan future program directions and budgets, and develop links with other public agencies and industry.

ENG participates in all seven areas, and plays a leading role in coordinating manufacturing and civil infrastructure systems (CIS). In the latter, proposals have been solicited, and expectations are that a portfolio of awards will be made for individual and group research projects in all CIS areas, as well as for team research focused on a new strategy for urban infrastructure renewal. A major goal of this program is to enable integrative research that addresses broader issues rather than improvements in isolated components or materials used in CIS.

In manufacturing, a new program announcement describes opportunities for research on environmentally conscious manufacturing. Such support will enable investigators from disciplines that have not traditionally been involved in the solution of environmental problems to adapt their specialized expertise to manufacturing strategies that minimize the need for remediation and restoration over a product's entire life cycle. Again, the emphasis will be on systems issues that require teams of scientists and engineers to work together.

Engineering News Highlights ✓

ENG Plays Key Role In Areas of National Interest 2
SPEC Meeting Discusses NSF Strategic Plan 2
Table-Top X-Ray Laser Demonstrated 2
NSF Launches New CIS Integrative Initiative 2
Major Step Taken In Data Storage 2
Tissue Engineering: A Promising Frontier 2
GOALI Success Spurs Expansion Plans 2
Natural Gas Research Grant May Solve Water Problem 2
Kobe Quake Enables Rare First-Hand Look 2
New Laser Technology May Foil Plastic Card Fraud 2
Co-Lab Provides Electronic Panel Meetings 2
ENG Announces NYI Awardees 2
WWW Browsers Come To NSF 2
Support Staff Briefings A Popular Event 2
Teaching Children About Engineering 2
Young Scholar Stunned by NSF 2

Ja

SPEC Meeting Discusses NSF Strategic Plan

Staff members of the Directorate for Engineering (ENG) are absorbing details of the NSF Strategic Plan and the role ENG will play in its implementation.

A recent all-hands meeting sponsored by ENG's Strategic Planning and Evaluation Committee (SPEC) provided an opportunity for members to become familiar with the plan and offered a forum for discussion of the plan, called "NSF in a Changing World."

NSF Director Neal F. Lane addressed the group, describing the all-important partnership NSF has with industry and academe. Dr. Devandra P. Garg, program director in ENG's Dynamic Systems & Control, Division of Civil and Mechanical Systems (CMS), and chair of SPEC, introduced the program and covered the main points of the NSF plan.

The new planning environment at NSF evolved after a number of events, including the end of the cold war, which had a major impact on research spending; cutbacks in Federal support for university research; and downsizing in corporate research. In addition, the Government Performance and Results Act mandates strategic planning in all agencies, and a recent White House report, "Science in the National Interest," requires all R&D agencies to develop long range plans.

The NSF plan establishes three major goals:

- To enable the U.S. to uphold a position of world leadership in all aspects of science, mathematics, and engineering
- To promote the discovery, integration, dissemination, and employment of knowledge in service to society

Continued on page 2

qty.

Continued from page 1

- To achieve excellence in U.S. science, mathematics, engineering, and technology education at all levels

Dr. Garg described a set of four core strategies that NSF will employ to maintain its agility and responsiveness as an organization. These strategies include developing intellectual capital, the strengthening of academe's physical infrastructure to provide for future needs, integrating research and education, promoting partnerships among the academic community, industry, government, and comparable organizations worldwide.

Within ENG, SPEC is charged with the responsibility of fostering, among other goals, a process of strategic thinking and action to involve optimal communication with the staff and the academic, private sector, and government communities.

Other speakers at the All-Hands meeting included Paul Herer, ENG Senior Advisor for Planning and Technology Evaluation, who discussed the ENG budget and how it relates to the plan, and Dr. Jorn Larsen-Basse, Program Director of CMS's Surface Engineering and Tribology program, who covered implementation issues. SPEC activities and their relationships to the plan were described by Ms. Stephanie White, CMS Center Manager, and Ms. Hope Duckett, Program and Administration Specialist, Division of Bioengineering and Environmental Systems.

Table-Top X-Ray Laser Demonstrated

The first demonstration of a table-top-sized soft x-ray laser (XRL) driven by a simple electrical charge is being reported by an engineer supported by a NSF grant. The finding by Dr. Jorge Rocca and his coworkers in the electrical engineering department, Colorado State University, Fort Collins, is being heralded as a major step in dramatically reducing the size and cost of XRL equipment while improving its efficiency.

Soft x-rays are extremely bright sources of collimated and coherent soft x-ray radiation, which are envisioned to open unprecedented possibilities in several fields of science, engineering, and technology, including biology (x-ray microscopy and holography of living cells), materials science, and development of new energy sources (diagnosis of fusion plasmas). Much progress has been made in the development of x-ray lasers utilizing large laser pumps, but their widespread use has been limited by their large size, low efficiency and high cost.

To circumvent these limitations, recent efforts by Dr. Rocca, supported by the Directorate for Engineering's Division of Electrical and Communications Systems, have explored amplification schemes that use smaller laser drivers and have led to his significant advance.

The first demonstration of a discharge pumped soft x-ray laser was obtained by using a compact table-top discharge that has the potential of being developed into an efficient, high-repetition-rate, cost-effective source for applications. Large amplification was demonstrated at 46.9 nm in neon-like argon. The discharge excitation technique Dr. Rocca and his group demonstrated has the potential of also producing amplification at other XUV soft x-ray wavelengths, and of improving the efficiency of soft x-rays by two orders of magnitude.

The journal *Physics Today* quotes Dr. William Silfvast (Center for Research in Electro-Optics and Lasers, University of Central Florida), as stating that the finding is the most significant development in the field since x-ray lasers were first demonstrated by Dr. Dennis Matthews and co-workers at the Lawrence Livermore National Laboratory in 1984.

According to *Physics Today*, Dr. Matthews himself concurs, calling it the most exciting advance he has seen in recent years. The journal also quotes x-ray laser expert Dr. Ray Elton (University of Maryland): "Rocca's achievement, getting away from the big laser drivers, is a giant step. In the next few years, many groups — probably mostly overseas — are going to be milking this advance."

NSF Engineering News is sponsored by the National Science Foundation's Directorate for Engineering (ENG). Its purpose is to promote current awareness of ENG activities throughout the engineering community by describing programs, policies, meetings, research projects, and other activities sponsored by the Directorate. For further information, contact the Editor, Glenn H. Larsen, Directorate for Engineering, National Science Foundation, Arlington, VA 22230, or call (703) 306-1306, e-mail glarsen@nsf.gov, TDD# (703) 306-0090. Additional Information by be obtained by contacting the Associate Editors in the Divisions, as follows:

Office of the Assistant Director (OAD)
(703) 306-1304
Ms. Deborah B. Young e-mail (dbyoung@nsf.gov)

Division of Bioengineering and Environmental Systems (BES)
(703) 306-1320
Ms. Hope Duckett e-mail (hduckett@nsf.gov)

Division of Chemical and Transport Systems (CTS)
(703) 306-1371
Ms. Johnetta E. Lee e-mail (jelee@nsf.gov)
Ms. Saundra E. Woodard e-mail (swoodard@nsf.gov)

Division of Civil and Mechanical Systems (CMS)
(703) 306-1360
Ms. Stephanie White e-mail (cgrier@nsf.gov)

Division of Design, Manufacture, and Industrial Innovation (DMII)
(703) 306-1301
Ms. Carol A. Guido e-mail (mdunn@nsf.gov)

Division of Electrical and Communications Systems (ECS)
(703) 306-1340
Ms. Michelle Dunn e-mail (mdunn@nsf.gov)

Division of Engineering Education and Centers (EEC)
(703) 306-1380
Ms. Esther M. Bolding e-mail (ebolding@nsf.gov)

NSF Launches New CIS Integrative Initiative

A broad-based, integrative initiative is being launched by NSF to put existing knowledge about civil infrastructure to work and generate new engineering and scientific knowledge. With a budget of $54.5 million in fiscal year 1995, the integrative research will be supported to involve engineers, economists, and physical, mathematical, materials, and social scientists.

The budget for civil infrastructure systems (CIS) research, distributed throughout NSF's disciplinary programs, includes an approximate $9.0 million increase over the previous fiscal year. This increase will be allocated for two areas — unsolicited proposals through existing programs in NSF's disciplinary research directorates and special competitions on integrative research in the following specific areas:

- Sensors and sensor systems (jointly funded by the Electric Power Research Institute);
- Composite and hybrid structures, and
- Systemic change in urban infrastructure.

New understanding of system performance and guidance in support of resource allocation decisions in CIS investment and management will be sought, rather than improvements in isolated civil infrastructure components.

CIS include all installations that house, transport, transmit, and distribute people, goods, energy, add CIS resources, services, and information. Because of aging, overuse, exposure, misuse, mismanagement, and neglect, many of these systems are deteriorating and becoming more vulnerable to catastrophic failure particularly when faced with natural disasters.

Inquiries concerning submissions under the unsolicited proposal program may be directed to Dr. Priscella Nelson by telephone at (703) 306-1360.

Major Step Taken In Data Storage

An NSF supported engineer at the University of Arizona is continuing his research after successfully demonstrating that holograms can be recorded on doped polymer films at high efficiency.

The finding by Dr. Nassar Peyghambarian, supported by the Directorate for Engineering's Division of Electrical and Communications Systems, is considered a remarkable discovery because the cost of fabricating the polymer films is orders of magnitude less than for the inorganic crystals.

For years it has been known that holograms could be recorded and read using large inorganic single crystals by making use of the photorefractive properties of the crystal. Such technology could lead to very high density data/information storage and retrieval systems based on nonlinear optics. Unfortunately, the cost of fabricating the crystals has kept the technology from becoming a practical reality.

The main problems yet to be solved involve the stability of the films under many read/write cycles during dark periods (no exposure to light) and over long periods of time. Another area of study is to overcome the lack of time response inherent in organic materials versus the inorganics. Once these hurdles are overcome, inexpensive systems for mass storage of data will become available.

Tissue Engineering: A Promising Frontier

The groundwork for developing biological substitutes for damaged tissue is being prepared by the new and evolving interdisciplinary field of tissue engineering which is drawing on the expertise of chemical engineers. So states an article in *Chemical and Engineering News (C&EN)* that reviews a host of advances, many of them supported by grants from NSF.

Tissue engineering is an activity predating its name, inasmuch as laboratories have been involved in this activity for decades. However, the term is relatively new, perhaps first used at an NSF-sponsored bioengineering panel in 1987. A followup session subsequently identified tissue engineering as an emerging technology and a funding priority.

"Tissue engineering," according to an NSF-sponsored meeting a year later, the first of its kind devoted solely to this field, "is the application of the principles and methods of engineering and the life sciences toward the fundamental understanding of structure/function relationships in normal and pathological mammalian tissues and the development of biological substitutes to restore, maintain, or improve functions."

Implied in this definition, writes Dr. Robert M. Nerem in a review article in the journal Tissue Engineering, is the essence of tissue engineering. "This is the use of living cells and/or extracellular matrix (ECM) components in the development of implantable parts or devices, or other approaches, which lead to the restoration or replacement of function."

Dr. Nerem, a NSF-supported investigator at the Georgia Institute of Technology, Atlanta, adds that "Sometimes these substitutes are referred to as bioartificial constructs, since they involve a biological component."

The two C&EN authors, Drs. Jeffrey A. Hubbell, California Institute of Technology, and Robert Langer, Massachusetts Institute of Technology, are themselves recipients of NSF funding. Langer, whose work is supported by the Directorate for Engineering's Division of Bioengineering and Environmental Systems, recently reported synthesizing a biodegradable copolymer and chemically attaching a biologically active peptide to it. The copolymer potentially could function as a matrix to hold mammalian cells and thus serve in the body as an artificial tissue or organ.

Hubbell and Langer call tissue engineering one of chemical engineering's promising frontiers. The field draws upon the chemical engineer's expert knowledge of fluid dynamics, mass transport, process modeling, materials design, and chemistry.

"Working with physicians and other biological specialists," the authors state, "chemical engineers are designing biocompatible casings for cell transplants, polymer composites for patching wounds, scaffolds that guide and encourage cells to form tissue, bioreactors for large-scale production of therapeutic cells, and experimental and mathematical models to predict cell behavior."

The authors state that tissue engineering has already proven valuable in developing materials that block unwanted reactions between transplanted cells and host tissue, in making polymer or polymer-cell composites for patching injured tissue to help prevent scarring during healing, in expanding therapeutic cells in culture, and in growing relatively simple tissues in the laboratory.

The list of challenges, however, remains long. It includes, for example, such missing information as how to develop universal donor cells that could be given to any recipient, how to stimulate regeneration of complex multicellular structures in vivo, how an organ directs the function of its cells — an understanding of which might lead to assembling an engineering system "that can both stimulate growth of a variety of cell types and arrange them in an appropriate morphological order at the appropriate time."

GOALI Success Spurs Expansion Plans

Three NSF Directorates, Computer and Information Science and Engineering, Mathematical and Physical Sciences, and Engineering (ENG), are now participating in the Grant Opportunities for Academic Liaison With Industry (GOALI) program. ENG completed its first successful year with GOALI in 1994. Other NSF Directorates are also considering joining the initiative that helps enable the intellectual partnership growing between industry and academe.

For individual or small group (two or three investigators) projects, GOALI provides faculty and students with expanded opportunities to enhance their research and educational capabilities in technologically rich environments. It also helps develop long-term collaborative research and educational programs with funding leveraged by industry. The program also facilitates technology transfer and enlarges job opportunities for students.

GOALI covers a wide spectrum of interaction mechanisms, from visits and industrial assistantships to full scale projects. Its importance is underlined by the synergism resulting from the individual industry-university collaborative projects, as well as by the increased need of basic research to support high-tech industry, and the need to improve the education of students hired by industry.

The main characteristics of the awards made in the first year of the program are:

- Novel technological developments in industry that were brought to the attention of university faculty, (i.e., polymer

Continued on page 4

Continued from page 3

molding for AT&T, metal flow for Alcoa, smart fluids for FORD, advanced fluidized beds for Exxon, and materials handling for DuPont)

- University research that has been enhanced by access to the industrial environment, larger and interdisciplinary teams, sharing of equipment, and research feed-back from industry, as well as the educational impact on students
- Awards which were made to both new and well-established academics, indicating an increasing interest on the part of academe for substantive interactions with academe
- Inquiries from industry which is looking for university professors to conduct fundamental research in areas of respective research interest, and which is proposing curriculum development and student training programs
- New research topics and modalities of collaboration which have originated from industry
- Other research initiatives which have introduced the GOALI approach to promote, for example, environmental issues, technical management, and industrial postdoctoral fellowships in mathematics, chemistry and engineering.

The response from the academic and industrial communities to GOALI is prompting NSF staff, principally Dr. M.C. "Mike" Roco, an ENG program director, to study the possibility of extending the program to promote more interaction with industry.

Natural Gas Research Grant May Solve Water Problem

NSF-funded research may provide a tool to help industry alleviate some of the costly problems associated with water in oil and natural gas pipelines.

Because water forms an unusual crystalline structure with some components of natural gas such as methane, ethane, and propane, U.S. natural gas pipelines are plagued by blockage. The water forms "cages" around the gas that are geometrically analogous to the "buckyballs" formed by carbon. The cages fuse to form crystal structures that can eventually block pipelines.

Each year, industry spends about $500 million injecting methanol, a hydrate inhibitor, into pipelines. (The methanol bonds to the water, preventing it from reacting with the natural gas.)

Research led by Dendy Sloan at the Colorado School of Mines determined that the structure of a previously unknown hydrate was well within the pressures and temperatures at which other hydrates were likely to form. The project team then developed a statistical thermodynamic model to predict conditions for formation.

The model, verified by experiments, is fast and cheap and allows pipeline operators to predict when crystals are likely to form, so that they can change pipeline conditions to prevent blockage.

Earlier research by other investigators had shown that a form of clathrate hydrates gas would form around larger hydrocarbon molecules by using a second "help" gas such as xenon or hydrogen sulfide. This new form was labeled structure H.

Sloan, looking at those results, realized that xenon is just a bit larger than methane. "If xenon is a help gas for these crystals, then methane might be, too," Sloan says.

Under a NSF Small Grant for Exploratory Research, he determined that structure H will form around molecules in natural gas as well as components indigenous to petroleum. His team also determined that the pressures and temperatures needed to create structure H crystals are similar to conditions for the two other identified clathrate hydrate structures.

Working next under a grant from the Directorate for Engineering's Division of Chemical and Transport Systems (CTS), the team developed the model to predict conditions in which structure H crystals may form in pipelines. The research team plans to make the model widely available — which will allow industry to predict conditions conducive to crystal formation and to make changes within the pipelines to avoid those conditions.

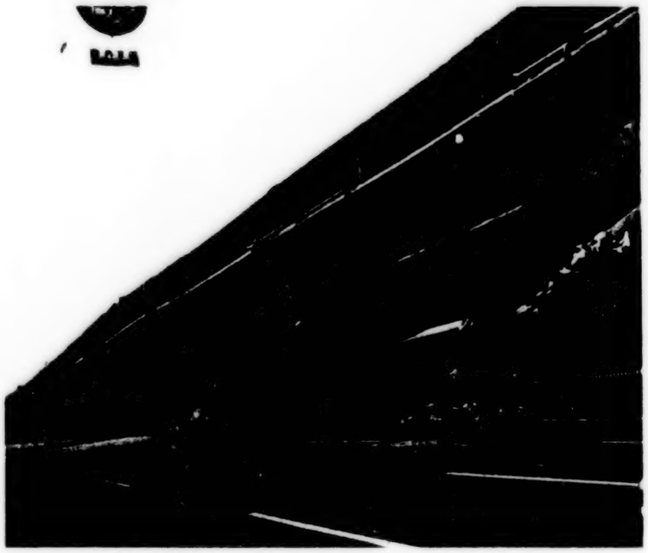
Says Dr. Kenneth R. Hall, CTS division director: "This is a terrific example of how the grant process should work. The researchers received a small grant to verify that structure H crystals can form in pipeline conditions and then went on to develop the project into a predictive model useful to industry."

Kobe Quake Enables Rare First-Hand Look

When conferees at an NSF-sponsored workshop on earthquake engineering met in Japan, they hardly expected to be present for the real thing. Possibly the only fortunate outcome of the Kobe quake in January is that it gave the experts a rare first-hand look.

The 7.2 tremor, lasting 20 seconds, killed more than 5,000 people and caused more than $200 billion in damage.

At the time of the devastation, a team of engineers and scientists were in Osaka, about 30 kilometers from Kobe, for an NSF-funded U.S. Japan Workshop on Urban Earthquake Reduction, cosponsored by the Earthquake Engineering Research Institute (EERI) and the Japan Institute of Social Safety Science.



Highway toppled from earthquake.

Dr. William A. Anderson, head of the Hazard Mitigation Systems program in the Directorate for Engineering's Division of Civil and Mechanical Systems, reports that the workshop participants immediately undertook preliminary post-earthquake reconnaissance efforts.

"After a damaging earthquake, it's important to get researchers into the field to collect information and make observations as soon as possible because much of the data is perishable and will disappear when the recovery process begins," he says.

"The U.S. group, made up of researchers from such disciplines as earthquake engineering, seismology and the social sciences, was able to undertake the earliest possible investigation and to collect information that would later be unavailable to other investigators."

Preliminary assessment indicated that the single most significant cause of damage was the proximity of affected cities to the fault rupture. In areas of heavy damage, the pattern indicates that a strong horizontal pulse, rather than the repeated shaking, caused most of the destruction.

The most extensively and severely damaged structures were smaller commercial buildings which often have a residence upstairs, constructed with limited engineering design, and traditional homes.

The smaller commercial and mixed occupancy buildings are typically framed with wood or light steel and have walls of stucco over wood slats. Many of these buildings have a large shop window in the front and lack interior walls, factors which weaken the first floor.

The Kobe earthquake exposed more modern and engineered buildings to stronger forces than any previous earthquake. The preliminary report indicates that more studies are needed to evaluate seismic codes, design practices, and construction methods; subsequently, improvements based on the studies need to be made.

"Though unfortunate," Anderson says, "large earthquakes are natural experiments that provide the opportunity to significantly advance knowledge in earthquake engineering and related fields."

Anderson notes that NSF has long supported quick-response post-earthquake investigations to complement the analytical and laboratory research it funds. "The Earthquake Engineering Research Institute (EERI) is playing a major role in such efforts through its NSF-supported Learning from Earthquakes Project," he says.

Copies of the preliminary report may be purchased for $15 prepaid from EERI, 499 Fourteenth Street, Suite 320, Oakland, CA 94612-1934.

NSF Support Makes Mark On Wind Engineering

Delegates to the Ninth International Conference on Wind Engineering (9ICWE) are in general agreement that an NSF- sponsored program at two universities is making an impact on wind studies, as well as providing an example of synergism and cooperation that can be achieved through multidisciplinary research.

The Cooperative Program in Wind Engineering between Colorado State University and Texas Tech University (CSU/TTU CPWE) is a unique five-year program which has produced significant research advancements using wind tunnel studies at CSU and field studies at TTU. The cross-disciplinary, cross-department, cross-university program enabled a large number of faculty and students to pursue a wide variety of wind-related research topics and accomplish technology transfer.

Seven faculty and three students in the program presented 20 papers at 9ICWE, held in New Delhi, January 9-13, 1995. Subject matter included wind characteristics, wind pressures on buildings, wind tunnel techniques and studies, and field/prototype measurements.

The latest in a series of conferences held every four years, the conference drew more than 300 delegates worldwide who heard almost 200 papers presented by investigators representing 25 countries. Travel for the CSU/TTU delegates was made possible in part through NSF funding to the Wind Engineering Research Council.

Dissemination of information gained as a result of the CSU/TTU project is an integral part of NSF's programs to mitigate the effects of natural disasters on the built environment.

New Laser Technology May Foil Plastic Card Fraud

A NSF supported engineer is perfecting optical encoding techniques which promise to make it nearly impossible to counterfeit credit cards, drivers' licenses, passports or virtually any other kind of identification card. The technology could also be used to authenticate software products, computer chips, high currency bills, and even Gucci bags.

The research is expected to have a strong impact on business, inasmuch as credit card fraud costs companies billions of dollars annually — losses which are passed on to the consumer — as well as to meet the security needs of government and industry.

Dr. Bahram Javidi, University of Connecticut, Storrs, under support from the Directorate for Engineering's Division of Electrical and Communications Systems, believes that sophisticated, technology-minded thieves are overcoming current protective methods to counterfeit IDs. The present use of code masking strips, miniature photographs of card-holders, and even the much-heralded holograms are of little protection, he says.

He and his colleagues, Drs. Joseph Horner of Rome Laboratory, Bedford, Massachusetts, and John F. Walkup of Texas Tech University, Lubbock, are testing further their optical encoding techniques — codes that alter the path of light — and developing a machine to decipher the codes. A patent is pending for the new laser technology which works as follows:

Digitized information stored on film permanently bonded onto a card is extracted when the card is exposed to a laser beam. If the card is authentic, an identification symbol appears. Besides proving a card's authenticity, the process could identify cardholders. Personal identifying information, such as fingerprints or facial features, also could be stored on a card. The laser decoding machine could be small enough to fit in the palm of a store clerk's hand.

Javidi and his coinvestigators, aided by graduate engineering students at the University of Connecticut, project that it would no longer be profitable to steal credit cards or to manufacture new ones using the numbers from another card because the counterfeits would be detected easily.

Co-Lab Provides Electronic Panel Meetings

The Engineering Directorate is collaborating with NSF's Division of Information Systems (DIS) in a pioneering effort to gain experience in conducting electronic panel meetings in a "Co-Lab" (collaborative laboratory).

Located in an NSF conference room, Co-Lab is configured to allow easy networking of a number of notebook computers. The automated system thus provides ease and privacy in the NSF proposal review process.

NSF uses a large number of reviewer panels during the year to assist in the proposal review process. They range in size from a few members to very large panels that meet as subpanels in several different rooms at the same time. Since the panel review process involves a number of group actions, it lends itself well to some automation via networked computers.

With this in mind, DIS set up Co-Lab, which includes a Pentium server with printer, and an overhead projector with screen. The software is Group Systems V, which was developed by Ventana Corporation based on some early work at one of NSF's Industry-University Cooperative Research Centers at the University of Arizona.

Continued on page 6

Continued from page 5

To date, the system has been used experimentally by the Surface Engineering and Tribology Program, Division of Civil and Mechanical Systems. This program is ideal to help assess the merits of Co-lab panels as it is a relatively small program with panels of only 4-8 members.

Co-Lab enables panelists to easily rank proposals jointly and to cast votes, anonymously if so desired. The software immediately tabulates the votes and calculates the mean and standard deviation, among other functions. The system is also very useful for joint preparation of panel summaries, as all panelists or sub-panelists working together can see the document on their own screens as well as on a large one. The electronic reports developed by the system are suitable for direct incorporation into the final review documents.

Drawbacks include the need for the special room and trained technographer and limits on the panel size that can be accommodated (currently about 10). Advantages include a user- friendly environment, instant feedback to the panelists, and immediate preparation of reports. When Co-Lab is used in combination with electronically collected reviews (e.g., via e-mail) the resulting final reports for NSF documentation and for use by the proposers are substantially improved over those generated under the current system.

Further information may be obtained by contacting Dr. Jorn Larsen-Basse, Director, Surface Engineering and Tribology (jlarsenb@nsf.gov).

ENG Announces NYI Awardees

The Directorate for Engineering (ENG) is supporting 45 new fiscal year 1994 NSF Young Investigator (NYI) awardees after considering 490 nominations out of the approximately 1,435 received by the Foundation during the same fiscal year.

NYI awards fund research by faculty members near the beginning of their academic careers and are intended to help universities attract and retain outstanding young Ph.D. engineers and scientists.

Because the NYI Program and the NSF Research Initiation Awards programs were incorporated into the new Faculty Early Career Development (CAREER) Program, FY 1994 was the last year that NSF made new NYI awards.

The following is a list of the ENG FY 1994 award recipients:

NYI AWARDEE	INSTITUTION	FIELD
Al-Qadi, Imad L.	Virginia Poly. Inst.	Structural Deterioration, Non Destructive Eval.
Alvarez-Cohen, Lisa	Univ. of Cal., Berkeley	Environmental Engineering
Aydil, Eray S.	Univ. of Cal., Santa Barb.	Processing of Electronic Materials
Baldick, Ross	The U. of Tex. @ Austin	Economic Operation of Power Systems
Betti, Raimondo	Columbia University	Bridge Engineering/ Structural Mechanics
Bhattacharya, Kaushik	California Inst. of Tech.	Materials Science/Mat's. Develop./Modeling
Blanchet, Thierry A.	Rensselaer Poly. Inst.	Surface Engineering, Ceramic Tribology
Blumenthal, Daniel J.	Georgia Inst. of Tech.	Communication Systems
Burghardt, Wesley R.	Northwestern Univ.	Complex Fluids & Processing — Structure
Cheeks, Teresa L.	Univ. of Cal., San Diego	Magnetic Fields
Chen, Gang	Duke University	Heat Transfer in Quantum Structures
Dai, Jian-Gang	Georgia Inst. of Tech.	Multiclass Queuing Networks
Dawson, Darren M.	Clemson University	High Precision Actuators for Electromech. Sys.
Doumanidis, Charalabos	Tufts University	Scanned Thermal Rapid Prototyping Process
El-Halwagi, Mahmoud M.	Auburn University	Process Synthesis for Waste Reduction
Flatau, Alison B.	Iowa State University	Mechanical Eng., Vibrations and Acoustics
Frost, J. David	Georgia Inst. of Tech.	Geotechnical Earthquake Eng.
Ghosh, Somnath	Ohio State University	Computational Mechanics for Materials
Glaser, Steven D.	Colorado Sch. of Mines	Non Dest. Eval. Techniques to Geotech. Eng.
Glasserman, Paul	Columbia University	Multistage Queuing Networks
Idriss, Rola L.	New Mexico State U.	Non Destructive Evaluation of Bridges
Jin, Jianming	U. of Ill. at Urbana	Image Processing A Grand Challenge
Khammash, Mustafa H.	Iowa State University	Control Theory Used on Power Systems
Khosla, Chaitan	Stanford University	Chemical Engineering
Long, Gregory L.	Univ. of Cal., Irvine	Force Reflect. Sys. for CAD Applications
Longmire, Ellen K.	Univ. of Minnesota	Particle-laden and Buoyancy-driven Flows
Mantell, Susan C.	Univ. of Minnesota	Non Destructive Eval. for Polymer Composites
Mastrangelo, Carlos H.	Univ. of Michigan	Manufacturing of Micro-electromechanical Sys.
Mulholland, James A.	Georgia Inst. of Tech.	Formation of Toxic Combustion Products
Nitsche, Ludwig C.	Univ. of Ill. at Chicago	Dialysis and Diffusion Gates for Membranes
Orme, Melissa E.	Univ. of Cal., Irvine	Nanophase Mat'l Synthesis Net-form Manuf
Perkins, Judy A.	Southern University	Transportation
Follard, Andrew E.	Tulane University	Biomedical Engineering
Renaud, John E.	Univ. of Notre Dame	Design Optimization Under Uncertainty
Richards, Cecilia D.	Washington State U.	Mechanical Eng., Thermal-Fluids, Combustion
Roberts, A. Lynn	Johns Hopkins Univ.	Environmental Engineering
Rutledge, Gregory C.	Mass. Inst. of Tech.	Liquid Crystal Polymers
Sah, Robert L.	Univ. of Cal., San Diego	Bioengineering
Schwartz, Daniel T.	Univ. of Washington	Electrochemical Transport and Reaction
Swartzlander, Grover A.	Worcester Poly. Inst.	Solitons in Communications
Tyler, Bonnie J.	Montana State Univ.	Chemical Engineering
Vakakis, Alexander F.	U. of Ill., at Urbana	Dynamics and Control of Linear/Nonlinear Sys.
Venkatasubramanian, V.	Washington State U.	Voltage Stability in Power Systems
Wilhelm, Robert G.	Univ. of NC @ Charlotte	Design, Fab., and Metrology of Sculp. Surfaces
Yin, John	Dartmouth College	Biotechnology

WWW Browsers Come To NSF

Now available to NSF staff are Mosaic and Netscape, information browsers of the Internet and World Wide Web (WWW) clients. Mosaic's graphical user interface (GUI) application can browse the Internet with multimedia capabilities, providing a galaxy of information and appealing text.

The WWW, the newest Internet service, makes it possible for text, graphics, audio, video and links to be incorporated in documents that are interconnected to other servers on the Internet.

WWW documents are written in HyperText Markup Language (HTML), which contain codes and formatting to present multimedia information and to link quickly to other information servers elsewhere on the Internet. Mosaic also provides access to other Internet services, such as anonymous File Transfer Protocol (FTP), Gopher, Wide-Area Information Service (WAIS), and UseNet servers.

If you have access to a browser like Mosaic, simply select "File" on the menu bar, then "Open URL..." This opens the URL (Uniform Resource Locator) box, where you type the specific Internet address of a server you want to access.

URL is a system which World Wide Web uses to standardize the addresses of various types of Internet services. Type the full address accurately, paying attention to the lower/upper case. For example, to link to the NSF, Engineering, homepage, type this URL address in your box:

```
http://www.nsf.gov/eng/start.htm
```

You can then save this address on your hotlist or bookmark file on your browser.

Support Staff Briefings A Popular Event

A voluntary, unofficial series of meetings organized by support staff members to inform their colleagues about their respective programs is proving to be a success.

The first Support Staff Briefing, attended by about 60 persons, featured a talk about Civil Infrastructure Systems given by Kimberly Bryant, a secretary in the Division of Civil and Mechanical Systems (CMS). Mr. Clifton Leach, a program assistant in the Division of Design, Manufacture, and Industrial Innovation, spoke at the next meeting about Advanced Manufacturing Systems. The Directorate for Engineering's (ENG's) administrative officer, Deborah Young, lent her expertise to organize, plan, and provide logistical and promotional support for the briefings.

One initiator of the program, Dr. Devendra P. Garg, program director, Dynamic Systems & Control, (CMS), says the concept originated with, and is sponsored by the (ENG's) Strategic Planning and Evaluation Committee

"The idea was to make it by and for support staffers," Garg says, adding that the presentations are non-technical and geared for people without a formal engineering background.

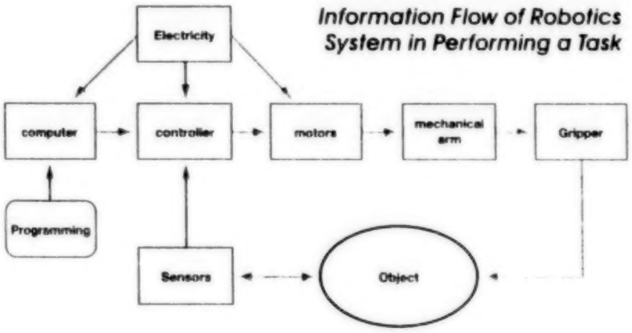
"Not only do we want to make them feel they're equal and indispensable partners in the whole ENG operation, but also to impart a better understanding of our activities so that they'd be in a better position to be more helpful to the outside community.

Teaching Children About Engineering: An Outreach Success Story

By Jay Lee

(Dr. Jay Lee is a program director in the Directorate for Engineering's Division of Engineering Education and Centers)

There are many ways to show children what engineers do. I've explored methods in teaching about robots, for example, and found a strategy that can help children logically formulate their own reasoning process. I call it "Think-it-Flow."



Information Flow of Robotics System in Performing a Task

Basically, it involves the use of an information flow chart to learn how to understand an object or a system by linking the functional relationship among components. But how can it be done in an interesting way so that the children won't become bored or overwhelmed? The following example was utilized to teach third and fifth graders about robots.

First, I described what a robot is and how it works and then asked the children to respond to questions during the lecture. Children enjoy being noticed, as well as challenged. Next, I showed a video highlighting practical aspects about robots, such as how engineers design artificial arms for disabled people.

Last, I divided the children into several small groups, giving each a set of papers. The pages contained words such as computer, controller, sensors, motors, electricity, and gripper. The children were challenged to put the words in order to show how a robot works.

It was easy for them to see that the robot is controlled by a computer which sends commands to a controller, which in turn sends signals to a motor. The latter moves the gripper to pick up an object detected by a sensor.

The children argued and debated about the sequences of these functions before performing the task as a team, describing the system logically when following the information flow chart.

Some kids even asked why not have multiple interactions among functions and wondered about the feedback loops. We were talking about task decomposition and integration which are the basic tools for engineers. The children learned that once they grasped a simple thinking strategy, they could apply it to any situation. They also learned of the close and important relationship between engineers and the dynamics of our society.

My reward is hearing that they want to be engineers when they grow up. With those words echoing in my ears, I'm reminded of what Emerson had said: "Enthusiasm is one of the most powerful engines of success. When you do a thing, do it with all your might. Put your whole soul into it. Stamp it with your own personality."

I believe enthusiasm is the key factor making NSF's outreach activities so successful.

Young Scholar Stunned by NSF

Jeffrey Van Sambeek is stunned by NSF research

Jeffrey Van Sambeek came to Washington, D.C. thinking he knew a lot about the National Science Foundation. After all, the Carbondale Community High School (Carbondale, IL) senior took a course back home in analog and digital electronics sponsored by NSF's Young Scholars Program, and he subsequently read about the Foundation.

So when he and the other 15 members of his honors government class were casting about, wondering which federal agency they would like to spend a mini-internship with during the class's annual visit to Washington, there was no question in his mind. Interested in engineering, he wrote to Dr. Elbert L. Marsh, Deputy Assistant Director, Directorate for Engineering (ENG), who promptly extended an invitation.

Jeffrey spent a week visiting with program heads, not only in ENG, but in many other Directorates. He says he was "overwhelmed and quite surprised" by the "sheer magnitude" of NSF research.

"The breadth of its support for research and education in basic science, math and engineering appears to be all- encompassing," he says. "What's also encouraging is the complete sense of cooperation I found among the Directorates. There seems to be absolutely no competition among them — the sort of thing you'd naturally expect to see in any large, segmented organization."

Jeffrey, who is interested in pursuing a major in architecture and a minor in engineering, is preparing a report about his observations for Dr. Marsh.

Staff Update

Mr. Anthony Centodocati, formerly with NSF's Division of Information Systems, is program director for the Small Business Innovation Research (SBIR) program. This program is part of the Division for

Dr. Oscar W. Dillon, Jr. accepted the leadership of of the Division of Civil and Mechanical Systems as Acting Division Director. Dr. William Hakala leaves us from that position to accept a two year IPA assignment at Salisbury State University, Maryland.

Dr. Janie M. Fouke joins ENG as Director of the Bioengineering and Environmental Division. Dr. Fouke is Associate Professor of Biomedical Engineering at Case Western Reserve University, Associated Faculty at the Electronics Design Center at Case Western Reserve University; and Adjunct Associate Scientist at Southwest Foundation for Biomedical Recarch in San Antonio, Texas.

Dr. John Howell is on a one-year IPA as program director in the Division of Chemical and Transport Systems' (CTS) Thermal Systems (Transport and Process). He is from the University of Texas at Austin.

Formerly with the Office of Planning and Assessment, Mr. George P. Johnson joins the SBIR program.

Dr. Chen-Ching Liu is on a one year IPA as a program director in the Division of Electrical and Communications Systems (ECS) Engineering Systems, and is from the University of Washington, Seattle.

Dr. Priscilla Nelson is a program director in Geomechanical, Geotechnical & Geo-Environmental Systems, and is from the University of Texas at Austin.

Mr. William Newfeld is now with the Division for Engineering Education and Centers (EEC). He is formerly with the Office of Planning and Assessment.

Ms. Linda Pagnett brings her experience to EEC as Divison Director Secretary.

Dr. Marvin H. White is on a one year IPA from Lehigh University as a program director in ECS' Solid State & Microstructures program.

NATIONAL SCIENCE FOUNDATION
ARLINGTON, VA 22230

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BULK RATE
POSTAGE & FEES PAID
National Science Foundation
Permit No. G-69

END

10-23-96